CLAIMS

1. (Currently amended) A method of employing coherent transmit diversity in a wireless communication network, the method comprising:

forming a plurality of transmit signals, each comprising a combination of information signals intended for different ones of a plurality of wireless receivers, such that, at each one of said wireless receivers, the intended information signals in the plurality of transmit signals tend to add in free space while the other information signals tend to cancel in free space; and

coherently transmitting said transmit signals from said plurality of transmitters over different propagation channels to said plurality of receivers.

2. (Original) The method of claim 1 further comprising maintaining a set of channel estimates for propagation channels between each one of said transmitters and each one of said wireless receivers.

3. (Original) The method of claim 2 wherein forming a plurality of transmit signals to be coherently transmitted from a plurality of transmitters as combinations of information signals intended for different ones of a plurality of wireless receivers comprises, for each said transmit signal:

determining a set of filters based on the channel estimates for propagation paths between a transmitter from which said transmit signal is to be transmitted and each one of said plurality of wireless receivers;

filtering said information signals in respective ones of said set of filters to form individually filtered information signals; and

summing said individually filtered information signals to form said transmit signal.

4. (Original) The method of claim 3 further comprising generating a channel estimate matrix comprising a plurality of matrix elements, each said matrix element characterizing the propagation channels between one of said transmitters and one of said wireless receivers.

5. (Original) The method of claim 4 further comprising generating said sets of filters for said transmit signals based on forming the adjoint matrix of said channel estimate matrix.

6. (Original) The method of claim 4 further comprising generating said sets of filters for said transmit signals based on forming the inverse matrix of said channel estimate matrix.

7. (Original) The method of claim 2 wherein maintaining a set of channel estimates for propagation channels between each one of said transmitters and each one of said wireless receivers comprises periodically updating a channel estimate matrix comprising matrix elements characterizing one or more propagation paths between each said transmitter and each said wireless receiver.

8. (Original) The method of claim 2 wherein forming a plurality of transmit signals to be coherently transmitted from a plurality of transmitters as combinations of information signals intended for different ones of a plurality of wireless receivers comprises, for each said transmit signal:

expressing said channel estimates in terms of frequency response;

determining a set of filters based on the frequency response for propagation paths between a transmitter from which said transmit signal is to be transmitted and each one of said plurality of wireless receivers;

filtering said information signals in respective ones of said set of filters to form individually filtered information signals; and

summing said individually filtered information signals to form said transmit signal.

9. (Original) The method of claim 8 wherein determining a set of filters based on the frequency response for propagation paths between a transmitter from which said transmit signal is to be transmitted and each one of said plurality of wireless receivers comprises adding numerator zeros to a zero/pole frequency response expression to flatten poles having an excessive response characteristic.

10. (Original) The method of claim 1 wherein coherently transmitting said transmit signals from said plurality of transmitters over different propagation channels comprises coherently transmitting said plurality of transmit signals from respective ones of a plurality of spaced apart transmit antennas.

11. (Original) The method of claim 10 wherein transmitting said plurality of transmit signals from respective ones of a plurality of spaced apart transmit antennas comprises:

synchronizing distribution of said transmit signals between radio base stations associated with said plurality of spaced apart transmit antennas; and

translating each said transmit signal at the corresponding radio base station into a signal suitable for transmission from one of said transmit antennas.

12. (Original) The method of claim 1 wherein coherently transmitting said transmit signals from said plurality of transmitters over different propagation channels comprises coherently transmitting said plurality of transmit signals on different polarizations from an antenna assembly having a like plurality of polarizations.

13. (Original) The method of claim 1 wherein employing coherent transmit diversity in a wireless communication network comprises employing coherent transmit diversity in a cellular communications network.

14. (Original) The method of claim 1 wherein forming a plurality of transmit signals to be coherently transmitted from a plurality of transmitters as combinations of information signals intended for different ones of a plurality of wireless receivers

15. (Currently amended) A method of transmitting signals in a wireless communication network from one or more transmitters to a plurality of receivers, the method comprising:

receiving a plurality of information signals at a transmit processor, each information signal intended for a different receiver;

generating a plurality of transmit signals by forming weighted combinations of said information signals based on channel estimates for propagation paths between said one or more transmitters and said plurality of receivers, wherein said weighted combinations are formed in consideration of the propagation paths such that, at each receiver, the information signals not intended for the receiver tend to cancel in free space, and the information signals intended for the receiver tend to add in free space; and

coherently transmitting said transmit signals from said one or more transmitters to said plurality of receivers.

16. (Original) The method of claim 15 wherein said one or more transmitters comprise a plurality of transmitters, and wherein coherently transmitting said transmit signals from said one or more transmitters to said plurality of receivers comprises coherently transmitting a different one of said plurality of transmit signals from each one of said plurality of transmitters.

17. (Original) The method of claim 16 wherein said plurality of transmitters comprise a plurality of spaced apart transmit sites, and wherein coherently transmitting a different one of said plurality of transmit signals from each one of said plurality of transmitters comprises transmitting a different one of said transmit signals from each one of said spaced apart transmit sites.

18. (Original) The method of claim 16 wherein said plurality of transmitters comprises a plurality of polarized antenna elements, and wherein coherently transmitting said transmit signals from said one or more transmitters to said plurality of receivers comprises transmitting at least one of said transmit signals on a different polarization than another of said transmit signals.

19. (Original) The method of claim 15 wherein said one or more transmitters comprise a common transmitter, and wherein coherently transmitting said transmit signals from said one or more transmitters to said plurality of receivers comprises transmitting said transmit signals from said common transmitter.

20. (Original) The method of claim 19 wherein said wireless communication network comprises a CDMA network, and further comprising using a different spreading code to form each one of said plurality of information signals.

21. (Original) The method of claim 20 further comprising forming said weighted combinations of said information signals based on cross-correlation interference at said receivers between said spreading codes.

22. (Original) The method of claim 15 wherein coherently transmitting said transmit signals from said one or more transmitters to said plurality of wireless receivers comprises coherently transmitting said plurality of combined transmit signals on a common communication channel.

23. (Original) The method of claim 22 wherein coherently transmitting said plurality of transmit signals on a common communication channel comprises coherently transmitting said transmit signals on a common TDMA frequency/time slot assignment.

24. (Original) The method of claim 22 wherein coherently transmitting said plurality of transmit signals on a common communication channel comprises coherently transmitting said transmit signals on a common CDMA code channel.

25. (Original) The method of claim 15 wherein generating a plurality of transmit signals by forming weighted combinations of said information signals based on channel estimates for propagation paths between said one or more transmitters and said plurality of receivers comprises forming a channel estimate matrix, wherein each matrix element comprises a polynomial in the delay operator z based on one or more path coefficients corresponding to one or more propagation paths between one of said transmitting stations and one of said wireless receivers.

26. (Original) The method of claim 25 wherein generating a plurality of transmit signals by forming weighted combinations of said information signals based on channel estimates for propagation paths between said one or more transmitters and each said wireless receiver further comprises:

filtering said plurality of information signals with IIR filters that are based on a determinant of said channel estimate matrix to generate filtered information signals;

filtering said filtered information signals in an array of FIR filters, wherein said array of FIR filters are based on an adjoint matrix of said channel estimate matrix; and

summing down columns of said array of FIR filters to generate respective ones of said transmit signals.

27. (Original) The method of claim 25 further comprising:

calculating a determinant of said channel estimate matrix; and

filtering each one of said information signals in an IIR filter based on said determinant.

28. (Original) The method of claim 27 wherein filtering each one of said information signals in an IIR filter based on said determinant comprises, for each information signal:

running said information signal in time-forward order through a filter that uses roots of said determinant that lie inside the unit circle; and

running said information signal in time-reverse order through a filter that uses inverses of roots of said determinant that lie outside the unit circle.

29. (Original) The method of claim 27 wherein filtering each one of said information signals in an IIR filter based on said determinant comprises basing said IIR filters on selected roots of said determinant.

30. (Original) The method of claim 29 further comprising selecting said roots of said determinant based on the proximity of each root to the unit circle.

31. (Original) The method of claim 30 further comprising selecting said roots of said determinant based on a residue of said roots calculated using Cauchy's residue theorem.

32. (Original) The method of claim 29 further comprising selecting different numbers of roots for each said IIR filter based on a delay spread capability of the wireless receiver corresponding to said information signal operated on by said IIR filter.

33. (Original) The method of claim 27 further comprising:

determining an adjoint matrix of said channel estimate matrix;

forming an array of FIR filters based on said adjoint matrix;

feeding said information signals after IIR filtering into said array of FIR filters; and

summing down the columns of said array of FIR filters to generate respective ones of said transmit signals, wherein each column of said array of FIR filters corresponds to one of said transmit signals.

34. (Original) The method of claim 25 further comprising determining a frequency domain expression for said matrix elements in said channel estimate matrix.

35. (Original) The method of claim 34 further comprising using said frequency domain expressions to implement power spectral shaping for said transmit signals to minimize signal power transmitted in spectral regions with high relative signal attenuation.

36. (Original) The method of claim 35 further comprising determining a spot-frequency inverse matrix for said channel estimate matrix based on said frequency domain expressions.

37. (Original) The method of claim 15 wherein at least one of said transmitters comprises a transmit antenna of a different polarization, and wherein coherently transmitting said combined transmit signals from said plurality of transmitting stations to said plurality of wireless receivers comprises transmitting at least one of said combined transmit signals on said different polarization.

38. (Original) The method of claim 15 wherein said one or more transmitters comprises a plurality of spaced apart transmit sites, and further comprising synchronizing distribution of said transmit signals to said spaced apart transmit sites to maintain coherency of transmission between said transmit signals.

39. (Original) The method of claim 15 wherein said one or more transmitters comprises a plurality of transmitters equal to said plurality of wireless receivers.

40. (Original) The method of claim 15 wherein said one or more transmitters comprises a plurality of transmitters greater than said plurality of wireless receivers.

41. (Currently amended) A method of reducing interference at one or more receivers, the method comprising:

pre-filtering information signals for one or more receivers using channel estimates representing propagation channels between two or more transmitters and said one or more receivers to form two or more transmit signals, such that said transmit signals combine in free space at said one or more receivers to reduce interference between information signals; and

transmitting a different one of said transmit signals from each one of said two or more transmitters.

42. (Original) The method of claim 41 wherein pre-filtering information signals for one or more receivers using channel estimates representing propagation channels between two or more transmitters and the receiver to form two or more transmit signals comprises forming transmit pre-filters using a channel estimate matrix representing a set of propagation channels between said transmitters and said one or more receiver.

43. (Original) The method of claim 42 wherein forming transmit pre-filters using a channel estimate matrix representing a set of propagation channels between said transmitters and said one or more receiver comprises forming said channel estimate matrix with matrix rows corresponding to said one or more receivers and matrix columns corresponding to said two or more transmitters, such that each matrix element represents one or more propagation paths between a given transmitter and a given receiver.

44. (Original) The method of claim 43 further comprising forming a filter array as the adjoint matrix of the channel estimate matrix.

45. (Original) The method of claim 43 further comprising forming IIR filters for each said information signal based on the determinant of the channel estimate matrix.

46. (Currently amended) A method of transmitting signals in a wireless communication network from a plurality of transmitting stations to a plurality of receivers, the method comprising:

forming a matrix of elements, each element being a multi-valued element describing the propagation path from one of said transmitting stations to one said receivers;

forming an inverse of said matrix comprising an adjoint matrix and a determinant;

determining the frequency response from a signal input in said communications network to a receiver for which the signal applied to said signal input is intended, assuming said inverse matrix is used for filtering and combining said applied signals to obtain signals for transmission from respective transmitting stations;

forming said applied signal based on information to be transmitted to said intended receiver and said frequency response so that the information is coded in said applied signal to produce a spectrum of the applied signal that ~~is efficient for transmitting said information to said intended receiver~~ has low energy at frequencies where said frequency response is indicative

of high net transmitted signal power attenuation of the total power transmitted from said transmitting stations in reaching said intended receiver and high energy at frequencies where said power attenuation is low.

47. (Canceled)

48. (Currently amended) The method of claim ~~47~~ 46 in which said signal spectrum is formed using the water-pouring technique.

49. (Original) The method of claim 46 further comprising:

filtering said applied signals using filters based on said adjoint matrix and said determinant.

50. (Original) The method of claim 46 in which said filters are based on said determinant with selected factors representative of frequency response peaks deleted.

51. (Currently amended) A wireless communication network comprising:

a transmitter operative to transmit a plurality of transmit signals to a plurality of receivers; and

a transmit processor operative to form said transmit signals as weighted combinations of individual information signals intended for respective ones of said plurality of receivers by weighting said information signals using

channel estimates representing propagation channels between said transmitter and said receivers;

wherein said weighted combinations are formed in consideration of the propagation channels such that, at each receiver, the information signals not intended for the receiver tend to cancel in free space, and the information signals intended for the receiver tend to add in free space.

52. (Original) The wireless communication network of claim 51 wherein said wireless communication network comprises a CDMA communication network.

53. (Original) The wireless communication network of claim 52 wherein said transmitter comprises a transmitting site operative to transmit said transmit signals to said receivers.

54. (Original) The wireless communication network of claim 52 wherein said transmit processor is further operative to form said weighted combinations of said information signals based on cross-correlation interference at said receivers.

55. (Currently amended) A wireless communication network comprising:

a plurality of transmitters operative to transmit a plurality of transmit signals over different propagation channels to one or more receivers; and

a transmit processor operative to form said plurality of transmit signals by pre-filtering one or more information signals intended for said one or more

receivers using channel estimates representing propagation channels between said transmitters and said one or more receivers;

wherein said transmit signals are formed by pre-filtering in consideration of the propagation paths such that, at each receiver, the information signals not intended for the receiver tend to cancel in free space, and the information signals intended for the receiver tend to add in free space.

56. (Original) The wireless communication network of claim 55 wherein said plurality of transmitters comprises a plurality of spaced apart transmitters, each said spaced apart transmitter transmitting one of said plurality of transmit signals.

57. (Original) The wireless communication network of claim 55 wherein said plurality of transmitters comprises a plurality of polarized antenna elements, and wherein at least one of said transmit signals is transmitted on a different polarization.

58. (Original) The wireless communication network of claim 55 wherein said plurality of transmitters comprises a plurality of base stations communicatively coupled to said transmit processor.

59. (Original) The wireless communication network of claim 55 wherein said transmit processor comprises a matrix calculator operative to form a channel estimate matrix, such that each matrix element in said channel estimate matrix represents one or more

propagation paths between one of said transmitters and one of said one or more receivers.

60. (Original) The wireless communication network of claim 59 wherein said transmit processor further comprises a numeric processor operative to form sets of filters to perform said pre-filtering of said information signals, said filter coefficients based on said channel estimate matrix.

61. (Original) The wireless communication network of claim 60 wherein said channel estimate matrix comprises matrix rows corresponding to receivers and matrix columns corresponding to transmitters, and wherein said numeric processor comprises an array of FIR filters formed as the adjoint of the channel estimate matrix to filter the information signals.

62. (Original) The wireless communication network of claim 61 wherein said numeric processor comprises IIR filters formed based on the determinant of the channel estimate matrix for filtering the information signals before filtering in said array of FIR filters.

63. (Original) The wireless communication network of claim 55 wherein said transmit processor comprises one or more digital signal processors.

64. (Original) The wireless communication network of claim 55 wherein said transmit processor comprises one or more memory elements for storing said channel estimates.